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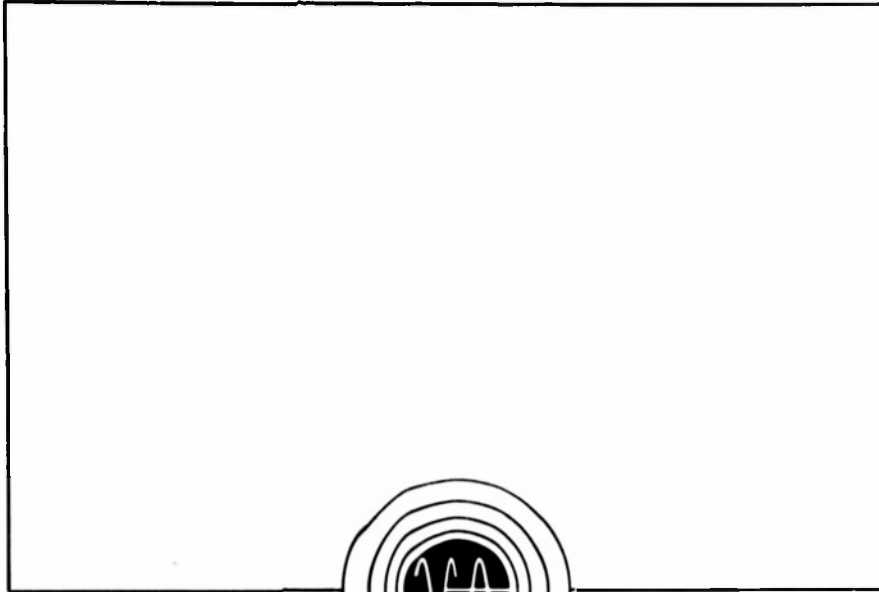
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Engineering Report
No. 101-29

Copy No. 1

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**VA-158 KLYSTRON OSCILLATOR
DEVELOPMENT PROGRAM**

Progress Report for
August 1954

Prepared for: Bureau of Ships
Navy Department

On: Contract No. N0bsr-52503
Index No. NE-110420

By: Peter H. Kafitz

Approved: SF Varian
Sigurd F. Varian
Vice-President for Engineering

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PURPOSE

The original purpose of the program covered by BuShips Contract No. NObsr-52503 was to develop a rugged local oscillator to comply with the Bureau of Ships Contract Specifications SHIPS-O-419, dated 15 March 1951, which was subsequently modified at a conference held at the Bureau of Ordnance, Washington, D.C. on 20-21 May 1952 and later at a conference held at Varian Associates on 29-30 September 1952. The tube was to be a reflex klystron operating in the frequency range from approximately 8.5 to 9.6 kmc, and its performance was to be similar to the 2K25 except for severe restrictions on frequency drift with temperature, frequency change due to shock, and FM noise due to vibration.

An amendment to Contract No. NObsr-52503 executed on 10 July 1953 changed the scope of this contract to incorporate additional development work, as follows:

I. Additional design work in connection with the prototype tube meeting the "1000-Tube Production Refinement Order Specification."

II. Long-range extended development including:

- A. Broadband matching to load: Elimination of the matching screw in the output iris to simplify the use of the tube.
- B. An investigation to improve repeller or modulation sensitivity and reduce sensitivity variations over the frequency range and from tube to tube.
- C. Elimination of undesirable modes.
- D. An increase in mechanical tuning range from 8.8 - 9.6 kmc to 8.5 - 9.6 kmc.

The product of the extended development program was designated the VA-158, to differentiate it from the V-52 developed on the original contract.

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The latest amendment to Contract No. NObsr-52503 was executed on 2 June 1954 and calls for still further electronic and mechanical improvements in VA-158. To meet the extended development requirements, the electronic tuning range must be substantially increased. The variation in reflector voltage sensitivity over the tuning range, and from tube to tube, must be reduced. Electronic performance should also be improved to increase the production yield in other respects, including power output and hysteresis. Other factors requiring study include variation of performance with gas pressure in the tube and filament voltage stability.

To accomplish all of the needed electronic improvements, it appears that a substantial redesign of the electron optical system is required. Such a design is being developed for other klystrons, and information obtained from that work can be adapted to improve the VA-158. The resulting performance should be significantly superior.

After the completion of the above electronic improvement program, work will be directed toward further simplification and ease of tuning.

At the conclusion of this program, six (6) sample tubes will be delivered representative of the engineering progress.

PROGRESS

For the reasons outlined in the last report¹, it was decided to redesign the tuning mechanism as the initial step in the extended development of the VA-158. A very smooth, non-microphonic tuner was developed which was satisfactory in all respects except life. During the past month, work was continued along this line, and after trying a number of combinations of materials, the life problem appears to be solved. The improved tuner is mechanically the same as that shown in Figure 1 of

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1 Varian Engineering Report No. 101-28

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the previous report . The extended life was achieved by giving the tuning shaft a highly polished chrome plate and making the female portion of the bearing of bronze. A very light application of molybdenum disulfide serves as a lubricant without adversely affecting the Q of the resonator.

Two tubes with the new tuner have been cycled over their full tuning range for more than 5000 cycles without change in performance. These tests are continuing.

PROGRAM FOR NEXT INTERVAL

During the next interval, the design of the improved electron optics, which constitutes the main objective of this program, will be started.

Estimated expenditures during August 1954: \$2,585.00

Estimated man-hours during August 1954: 286

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Subject: VA-158 Klystron Oscillator Development Program

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